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duce a radiating change that gradually works over and modifies the entire egg. Boveri's *archoplasm* does not exist except as this radiating area of influence. 5. In this radiating mass there is no centrosome, no sperm centre—nothing but a mass of nucleo-albuminiferous enchylema discharged from the sperm and in process of solution. 6. Up to the time of cleavage there are no centrosomes in the protoplasm and there can be no "quadrille of the centres." 7. The centrosomes arise early in the pronuclei, one in each, as nucleoli. 8. One centrosome comes out of the sperm nucleus and one out of the egg and they function as soon as they get into the eggs protoplasm, to form asters. 9. The spindle is made from the network of the nucleus, (fused sperm and egg nuclei), under the influence of the centrosomes. 10. The centrosomes do not divide but dissolve; the asters also disappear without dividing. 11. In each new nucleus two new nucleoli arise and after a dormant period pass out to function as centrosomes in the next cleavage.

Fertilization is thus a most complex process in which two individuals of different origin merge into one new entity of mixed nature; mixed not only in chromosomes but in all parts; cytoplasm, caryoplasm, centrosomes, all of double origin, male and female.

The egg may transmit the properties of both parents since it acts as a mixed being of double origin in all parts, throughout cleavage and subsequently. The entire egg not only the nucleus but also the outer protoplasm may be concerned in heredity.

As life remains a complex of mysterious and unexplained phenomena the author deems it folly to venture hypotheses as to the nature of heredity. "Sachons avouer notre ignorance profonde et nous arrêter à la limite de notre modeste savoir."

## PSYCHOLOGY.[1]

**The Physical Basis of Pain.**—The unsettled state of opinion among psychologists in regard to the nature of pain was touched upon last year in these notes.[2] The chief points at issue are whether pain and pleasure should be classed as sensations or as affective elements of consciousness, and how far a distinction should be drawn between so-called physical pain (Schmerz) and pain in the sense of displeasure (Unlust). The older theories in general regarded pain solely as a feeling, without any distinct physiological basis at all. The use of a single term in English for both Schmerz and Unlust has tended to obscure their difference, but recent discussion has brought it out with greater distinctness, and many writers now regard pain—at least when it involves some definite locality, as in the case of head-ache, tooth-ache, pricking, etc.—as a real sensation.

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[1] Edited by Howard C. Warren, Princeton University, Princton, N. J.

[2] November, 1896, p. 948.

Attempts have been made, in connection with this view, to discover definite end-organs and nerve tracts for the pain sense. The probability of the existence of such a physical basis has lately been urged with great force by a number of writers, on the evidence furnished by certain pathological cases, where localized hyperalgesia or analgesia occur without any marked alteration in the senses of pressure or temperature. They argue that if pain can be heightened or deadened without disturbance of the other dermal senses, it must be furnished with a distinct sensory apparatus of its own. Numerous clinical cases, reported by Dr. Henry Head in a series of articles in "Brain,"[3] lend considerable support to this view. These observations and others have been regarded as direct evidence that pain has a distinctive anatomical and physiological basis—either a complete set of end-organs and nerve apparatus, or at least a separate conducting tract and cortical center. Several objections have been raised against the more radical view, the chief being that no type of end-organ has been found in the skin, apart from those required for the senses of pressure and temperature.

A recent paper by Prof. Witmer, of Pennsylvania, reported at the British Association this summer and since published,[4] recognizes the force of this criticism, and favors the modified view of a spinal tract and center for pain. Prof. Witmer reviews the clinical and experimental evidence in great detail, taking up the parts of the sensory apparatus separately.

"There is no conclusive anatomical evidence," he says, "for the existence of a peripheral sense organ or nervous end organ for pain. There is no conclusive evidence for the existence of peripheral pain nerves or peripheral sensory neurons. Much evidence justifies the conclusion that all or some peripheral nerves may, under adequate stimulation, act with specific pain-producing function ; that such nerves may lose this function without a loss of other functions or may lose their other specialized sensory functions without losing the pain function. Local peripheral analgesia and analgesia due to compression or disease of the peripheral sensory neuron make the assumption of peripheral pain nerves and sense organs one that stands closely related to the facts.

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[3] Vols. XVI, p. 1 ; XVII, p. 339, and XIX, p. 153.

[4] Twentieth Century Practice of Medicine, 1897, XI, p. 905.

"There is a specialized pain tract in the spinal cord which is certainly constituted in part by the gray column, and which may be composed of a part of the gray column on both sides, including the commissure and a part of the lateral tract. Into this pain tract, nerves from the sympathetic system and from the internal organs, together with all specialized nerves from the periphery, discharge their stimulation when this is relatively intense. The intensity necessary to bring about this discharge may be that which is sufficient to overcome the resistance offered by the tract. This tract passes up through the optic thalamus and posterior limb of the internal capsule, the 'carrefour sensitif,' into the cerebrum, and reaches some region unknown, but probably a part of the somæsthetic area. This hypothetical region of the somæsthetic area may be looked upon as the pain centre.

"There is some warrant of justification for considering the pain tract in the spinal cord as the spinal nerve organ of pain, which, together with the hypothetical specialized cortical centre, constitutes the specific organ of pain. Any part of this central pain organ may be stimulated in the cortex or below it, either by stimuli discharging into it through normal physiological processes, by spinal or cortical association, by irritation due to disease, and perhaps by a vascular disturbance within the central nervous system.

"Thus pain may be a sensation of purely central nervous origin. The arousal of pain by stimuli and its presentation in consciousness along with other sensations may be explained by the simultaneous association of pain with other forms of stimulation—an association that may take place at any level of the nervous system. When such association takes place in the cortex, we have conscious association, the connection of pain with other sensations, with percepts, or with ideas." * * * * The universality of pain association with sensations of maximal intensity is explainable anatomically and physiologically by the discharge of intense stimuli carried by all peripheral nerves into the central pain organ: that this central pain organ has no peripheral nerves of its own, possessing a specific pain function and no other, can receive satisfactory explanation only from biological considerations of the significance of pain as a warning against dangerous stimuli of the environment. This fact would suggest an early phylogenetic development of a pain sense in the organism; in fact, the pain sense may have been the first of all the special senses."[5]

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[5] Op. cit., pp. 940–941.

If this analysis be accepted, it will naturally follow that pain must be regarded as a sensation alongside of the sensations of pressure, temperature, etc., but differing from them in having no specific end-organ, and depending upon them for its stimulation. It is scarcely necessary, then, to turn to introspection for further evidence. Prof. Witmer says: "Pain is a simple, unanalyzable mental content. It should therefore be called a sensation." The advocates of a dual or triple divison of the elementary data of consciousness will, of course, deny this argument *ab initio.* But the physiological evidence is another matter, and the hypothesis is sufficiently well grounded to call for careful consideration and discussion.—H. C. W.

**Baldwin's Social and Ethical Interpretations in Mental Development.**[6]—Following up the line of thought of his earlier work, on "Mental Development in the Child and the Race," Prof. Baldwin, in the present volume, considers the social aspects of that development. The connection between the individual and society he believes to be very close. On the one hand the mental growth of the individual is more or less controlled by conditions in the social environment; on the other hand, the forms of organization, growth and activity of society are analogous to those of the individual organism. Prof. Baldwin examines both of these relations in turn. The development of the notion of Self in the child proceeds *pari passu* with the rise of the notion of Other. The social environment furnishes him with a vast store of traditions and customs (social heredity) which form an important factor in his mental life; this same environment supports him where he conforms to its standards, and "suppresses" him where he does not. The inventive function, too—that by which the individual arrives at new results, different from his mere imitations of others—is guided by social approval and disapproval. In all these phases of individual growth the social environment supplements the instincts and other endowments derived from biological and psychological heredity. The author concludes this part of his work with an analysis of the elements in man's mental constitution which fit him for the social relation (sympathy, social intelligence, ethical sentiment, etc.), and a comparison of the sanctions, personal and social, which determine his acts.

In taking up the problem from the standpoint of the social organization, the author considers (1) the forces which control society, (2) the

[6] Social and Ethical Interpretations in Mental Development. By James Mark Baldwin. New York: The Macmillan Co., 1897, pp. xiv, 574, $2.60.

material and process of social organization, and (3) the nature of social progress. As regards the first question, he finds two distinct influences at work in society; the individual is a *particularizing* force, while the social organization itself tends in the direction of *generalization.* The *matter* of society consists, he says, of "intellectual states, such as imaginations, knowledges and informations." These "originate in the mind of the individuals of the group, as inventions, more or less novel conceptions, what we have called 'particularizations.' At their origin there is no reason for calling them social matter, since they are particular to the individual. They become social only when society—that is, the other members of the social group, or some of them—also thinks them, knows them, is informed of them. This reduces them, from the individual and particular form to a general or social form, and it is only in this form that they furnish social material, through what has been called, again, the 'generalization' effected by society" (pp. 487–8). The *process* of organization is through imitation: the individual particularizes in his exercise of imitation; society, by imitating the thoughts of particular individuals, generalizes them.

### SELECTION.[1]

| SORT. | MEANS. | RESULT. |
|---|---|---|
| 1, 2. Natural Selection I. (Darwin, Wallace, Spencer) [40]. | 1. Struggle for Existence (Darwin, Wallace). | 1. "Survival of the Fittest" Individuals (Spencer). |
| II. (Eimer) [40]. | 2. Inherent Weakness, without Struggle. | 2. Destruction of Unfit Individuals. |
| 3. Germinal Selection (Weismann). | 3 Struggle of Germinal Elements. | 3. Survival of Fittest Germinal Elements. |
| 4. Intra-Selection (Roux, Weismann, Delage). | 4. Struggle of Parts (Roux). | 4. Survival of Fittest Organs. |
| 5. Functional Selection (Baldwin). | 5. Overproduction of Movements, (Bain, Spencer, Baldwin). | 5. Survival of Fittest Functions. |
| 6. Organic Selection (Baldwin, Osborn, Lloyd Morgan) [Appendix A]. | 6. Accommodation (Baldwin); Individual Adaptation (Osborn); Modification (Lloyd Morgan). | 6. Survival of Accommodating Individuals. |
| 7. Artificial Selection (Darwin). | 7. Choice for Planting and for Mating Together. | 7. Reproductions of Desirable Individuals. |
| 8. Personal Selection[2] [40]. | 8. Choice. | 8. Employment and Survival of Socially Available Individuals. |
| 9. Sexual Selection (Darwin) [40]. | 9. Conscious Selection by Courting, etc. | 9. Reproduction of Attractive Individuals. |
| 10. Social Selection[2] [40, 120]. | 10. Social Competition of Individuals and Groups with Natural Selection (Malthus, Darwin). | 10. Survival of Socially Fittest Individuals and Groups. |
| 11. Social Suppression[2] [38 ff.]. | 11. Suppression of Socially Unfittest (by Law, Custom, etc.). | 11. Survival of Socially Fit. |
| 12. Imitative Selection[2] [40, 121, 307].<br>Social Generalization[2] [121, 310 ff.]. | 12. Imitative Propagation from Mind to Mind with Social Heredity. | 12. Survival of Ideas. |

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[1] I am indebted to Professor Lloyd Morgan for several suggestions utilized in the Table.

[2] Suggested in this work.

The *progress* of society is, in its method, direction and impelling motives, "analogous to the growth of consciousness rather than to that of the biological organism;" hence Prof. Baldwin objects to the application of the term *organism* to society, and prefers *organization.*

It would be impossible here to enter into any more minute examination or criticism of the positions maintained in this work. Attention should be called, however, to Prof. Baldwin's classification of the various sorts of developmental "Selection." The accompanying table, reproduced from Appendix B of the book, shows a number of distinct types, together with the authors who have discovered or elaborated them. The arrangement begins with the purely biological agencies, and proceeds up through the psychological to the social. The table furnishes a valuable contribution to evolution literature; the distinction drawn between the means, the result, and the name given to the process itself, clears up a number of points in regard to which considerable confusion has hitherto existed.—H. C. W.

## ANTHROPOLOGY.

**The History of Mankind.**[1]—The second volume of the translation of Prof. Ratzel's "History" more than meets the expectations of students of ethnography and others who have awaited its appearance with no little interest. The "modern method" of treatment and the wealth of illustrations continue to be prominent and pleasing features.

"Book II" describes (1) The Cultured Races of America; (2) The Ancient Civilized Races of America; (3) The Arctic Races of the Old World. Book III, The Light Stocks of South and Central Africa. Book IV, The South and East Africans.

The American tribes are not considered in detail, but in culture groups as the Forest and Prairie Indians of North America, the Forest Indians of Central and South America, the Pategonians, the Fuegians, etc. No general treatise has heretofore so fully described the inhabitants of the southern portion of the South American Continent. Some of the prevailing stories regarding their utter wretchedness are contradicted, and we learn that "the Fuegians are, at the bottom, Indians like all the rest," and our estimate of their disposition and

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[1] *The History of Mankind.* By Professor Friedrich Ratzel. Translated from the second German edition by A. J. Butler, M. A., with introduction by E. B. Tylor, D. C. L., F. R. S., with colored plates, maps and illustrations. 1897, N. Y., Macmillan, Vol. II, pp. 562.